GIANT STOMATA IN SOME MEMBERS OF
THE GENUS IXORA L. (RUBIACEAE)

TARIQ HUSAIN and S. R. PAUL

Taxonomy & Herbarium Discipline,
National Botanical Research Institute,
Lucknow 226 001, India

GIANT or primary stomata have earlier been reported
in some members of Rutaceae and Anacardiaceae1, 2.

Based on SEM examination of the abaxial surface of
the leaf we find giant stomata in *Ixora andamensis*
Brem., *I. monticola* Gamble and *I. saulieri* Gamble
with long radiating striae (figures 1A–C).

The leaves in the genus *Ixora* L are hypostomatic
and trichomes are completely lacking. Periclinal walls
of the lower epidermis are flat and striate and cell
boundaries are not clear. Stomata are exclusively
globose in *I. monticola* (figure 1B) but elliptical to
globose in the other two species (figures 1A, C).
Stomata are situated at the same level as other
epidermal cells and prominent peristomatal rims are
present around them. Fine granular wax is present on
the abaxial surface in *I. monticola* and *I. saulieri*.
The giant stomata which, except for their size and long

Figures 1A–C. Scanning electron micrographs of the
abaxial surface of the leaf showing giant stomata.
A. *Ixora andamensis* Brem. (C. E. Parkinson 140, DD).
B. *Ixora monticola* Gamble (J. L. Ellis 18638, MH).
C. *Ixora saulieri* Gamble (M. A. Lawson s.n., MH)
Bar = 10 Mm.

radiating striae, are indistinguishable from the normal
stomata.

Thanks are due to CSIR, for a fellowship to Th, and
to Mr. A. K. Dwevedi for technical assistance.

20 November 1984

35, 641.
p. 111.

EMBRYO SAC HAUSTORIA IN ECHINOPS
ECHINATUS DC

H. MAHESWARI DEVI and N. PADMA

Department of Botany, Andhra University,
Waltair 530003, India.

*ECHINOPS ECHINATUS* DC, an interesting xerophyte of
the family Asteraceae is a small, erect and spiny herb
(figure 1). It grows abundantly in the sand-dunes of
Visakhapatnam. This annual appears during
September, persists upto June and flowers from
middle of November to June. The sessile leaves are
pinnatifid with spinous projecting margins. The single-
flowered capitula aggregate into terminal spiny balls.
The involucral bracts emerge and protrude out as woody spines.

Asteraceae is an interesting family not only in its habit and habitat but also in its internal morphological characters. Although most of the interesting embryological features—different types of embryo sac development, antipodal and synergid haustoria, polyspermy, apomixis, polyembryony etc occur in this family, in no case so far embryo sac and endosperm haustoria are reported. However, in *E. echinatus* the

---

**Figures 1-5.** 1. Twig of *E. echinatus* DC. 2. Organized embryo sac × 320. 3. Embryo sac showing embryo sac haustoria × 252. 4. An elongated synergid haustorium × 320. 5. Embryo sac showing synergid and antipodal haustoria × 320. (eh: embryo sac haustoria; sh: synergid haustorium and ah: antipodal haustorium)
development of embryo sac haustoria from the middle of the embryo sac is recorded for the first time.

The integumentary tapetum, which is uniseriate with uninucleate cells, differentiates at the megaspore tetrad stage. In *E. echinatus*, the development of the embryo sac is of the polygonal type. The young embryo sac is spindle-shaped (figure 2). Synergids are without hooks. The antipodal cells are uninucleate and three in number. During organization the wall of the embryo sac is smooth and more or less abuts the inner wall of the integumentary tapetum (figure 2). Later the embryo sac becomes broader at the centre and remains narrow at both the ends (figure 3). At this stage from the middle of the embryo sac on either side small finger-like protuberances appear and protrude into the integumentary tapetal cells. Gradually these protuberances invade the tapetal cells, absorb their contents and finally obliterate them. The accumulation of dense cytoplasm in these protuberances as well as in the embryo sac and the depleted contents of the obliterated cells of the integumentary tapetum and surrounding tissue indicate the haustorial nature of these protuberances. Simultaneously from the synergids and also from the antipodal cells haustorial processes develop towards the micropylar and chalazal regions of the embryo sac respectively. From the tip of the synergids small narrow protuberances intrude into the micropyle. Gradually they become long haustorial structures invading the tissue on either side of the micropyle. However, one of the synergid haustoria (figure 4) is aggressive and forms a tubular structure destroying and absorbing the contents of the integumentary tissue on either side, while the other synergid haustorium remains behind and is not so aggressive.

Of the three antipodal cells the upper one elongates and becomes somewhat curved (figure 3). It grows downward, crushes the other two antipodal cells and thereby makes its way into the chalazal tissue. Finally this antipodal cell becomes the haustorium (figure 5), which not only crushes and absorbs the integumentary tapetal cells adjoining it but also crushes and absorbs the contents of the chalazal tissue. Because of these haustoria the surrounding cells of the integumentary tapetum become distorted in their shape and depleted of their contents. The ovular tissue around the embryo sac forms a pseudoperidochetal zone (figure 3). Thus in *E. echinatus* the occurrence of embryo sac haustoria besides antipodal and synergid haustoria is recorded for the first time.

In Asteraceae, in a few cases such as *Calotis lappulacea*¹, *C. cuneifolia*² and *Melampodium diversum*² the embryo sacs become elongated and protrude into or beyond the micropyle as a rare feature. But in none of the cases the direct haustorial activity of the embryo sac wall is recorded. Such instances have not been hitherto reported even in the closely related families of Asteraceae. In most other members where embryo sac haustorium is present usually it is reported as a caecum-like structure. The presence of such finger-like outgrowths from the middle of the embryo sac wall is reported in *Excorpus strictus*⁴. This particular type of embryo sac haustoria is known to occur only in this parasitic member of Santalaceae which may be regarded as an efficient method to provide nutrition to the developing female gametophyte and embryo. Likewise in *E. echinatus* also the occurrence of embryo sac haustoria may be correlated with nutritional function in view of the xeric habitat. Probably in this plant also the embryo sac haustoria from the middle region besides synergid and antipodal haustoria may be regarded as a special device to provide nutrition to the developing female gametophyte, so as to ensure increased fertility and seed set. In the absence of relevant literature indicating a possible correlation between the xeric habitat of the plant and the development of the embryo sac haustoria, it is suggested that further investigations in this direction could be of some use in elucidating the behaviour of female gametophyte under water stress.

NP is thankful to the authorities of Andhra University for the award of a fellowship.

4 December 1984


A POTENT SYSTEMIC INHIBITOR OF PLANT VIRUS INFECTION FROM AERVA SANUGUINOLENTA BLUME

H. N. VERMA and ALKA SRIVASTAVA
Botany Department, Lucknow University.
Lucknow 226007, India.

PLANTS belonging to Centrospermae are well known to contain substances which inactivate the virus or interfere with its establishment/multiplication¹⁻⁵. In